International Journal of Agriculture
Science and Research (IJASR)
ISSN (P): 2250–0057; ISSN (E): 2321–0087
Vol. 10, Issue 1, Feb 2020, 7–14
© TJPRC Pvt. Ltd.

TRANS STELLAR
•Journal Publications •Research Consultancy

GERMINATION OF THE SEEDS OF *RHUS SEMIALATA* MURRAY UNDER FIELD CONDITION TO CHECK THE SUITABILITY FOR PROPAGATION BY SEEDS

NADA TADI

Centre for Japanese Studies, Jawaharlal Nehru University, New Delhi, India

ABSTRACT

Present study was carried out at the nursery of NWFP division, Forest Research Institute, Dehradun, Uttarakhand, India to investigate whether Rhus semialata Murray can be propagated by the seeds by observing the germination of the seeds in field conditions. The seeds were collected from Mao (Manipur, India) and a nursery bed of 1.5m x1m size having uniform mixture of soil, sand and farmyard manure in 2:1:1 ratio was prepared. Also, a part of the fresh seeds was subjected to 0.5% dilute Sulphuric acid treatment before sowing. A total of 500 seeds were sown in the nursery bed in three groups of fresh seeds, one year old seeds and fresh seeds which were treated with 0.5% dilute sulphuric acid. After observing the germination of the seeds and running the observed and collected data through statistical analysis, it was found that the fresh seeds gave very little germination (2%), whereas one year old seeds gave 14% germination. The seeds which were subjected to pre-treatment with 0.5% dilute sulphuric acid gave 28% seed germination. Thus, R. semialata can be propagated by seeds either by using at least 1 year old seeds or after pre-sowing treatment with dilute sulphuric acid, which gives best outcome.

KEYWORDS: Rhus Semialata Murray, Seed Germination, Fresh Seeds, One Year Old Seeds & 0.5% Dilute Sulphuric Acid Pre-Sowing Treatment

Received: Nov 11, 2019; **Accepted**: Dec 01, 2019; **Published**: DEC 30, 2019; **Paper Id**.: IJASRFEB20202

Original Article

1. INTRODUCTION

India has been endowed with vast wealth of forest and has been recognized as one of the top 12 bio-diversity centres of the world due to varied ecological and climatic conditions. People in India have been utilizing bio-resources for different purposes like food, medicines etc. for thousands of years. *Rhus semialata* Murray (syn. *R. chinensis* Mill.; *R. javanica* Linn.) belonging to Anacardiaceae family, and also known as Chinese Sumac is one such tree which has been used by indigenous people of North-east India for food as well as medicine over the ages.

R. semialata Murray grows in the outer Himalayan ranges at an altitude of 3,000–7,000 ft, the hills of Assam, Khasi, Naga and Sikkim in India (Gurung, 2002; Rai and Sharma, 1996; Bhattacharjee, 1998), upper Burma, China and Japan (Kiritikar & Basu, 1987). It can be a shrub or a small tree up to 6m height with spreading crown. It is deciduous in nature and the fruiting period is from December to April (Singh et al., 2014). Fruit are round, flat with diameter of about 0.5 mm and thickness of 2–3mm, fleshy, hairy and orange to red in colour. Seeds are hard and brownish black.

Figure 1: The Fruits of *Rhus Semialata* Murray.

The edible fruits of *R. semialata* Murray have sharp acidic taste and can be consumed along with seeds. Traditionally, the infusion of fruits is used in case of diarrhoea and dysentery. The fruits can be powdered and mixed with egg and given to person suffering from in kidney trouble, urinary complaint due to the stone (Lokendrajit et al., 2011). *R. semialata* fruit pulp is mixed with 1 tsp of Stingless honey to drink with warm water once a day at night time for three days, to treat Gastritis (Zhasa et al., 2015).

They contain nutrients like protein, fat, carbohydrate, dietary fibre and vitamins like vitamin C, folates, carotenoids and α-tocopherol. Also, they are rich in minerals like Fe, Ca, Zn, K, Na and P (Bidyalakshmi et al., 2019). The fruits contain tannin, gallic acid and the potassium acid salts, together with small amount of aluminium, calcium, magnesium and iron, acid salts of maleic, tartaric and citric acids (Anonymous, 2003).

The gall of *Rhus semialata* Murray (also called Chinese galls*)*, has long been considered to possess many medicinal properties (Zhang *et al*., 2009). They are rich in gallotannins (Tian *et al*, 2009), a type of hydrolysable tannins. They are used in Chinese medicine to treat coughs, diarrhoea, night sweats, dysentery and to stop intestinal and uterine bleeding (Stroyan, 1997). *R. semialata* Murray compounds possess strong antiviral, antibacterial, anticancer, hepatoprotective, antidiarrheal and antioxidant activities (Djakpo and Yao, 2010). Gallic acid (3, 4, 5-trihydroxybenzoic acid), isolated from *Rhus semialata*, induces apoptosis in human monocytic lymphoma cell line U937 and may be a potential chemotherapeutic agent against lymphoma. (Kim *et al.*). The gall of *Rhus semialata* inhibits alpha-glucosidase activity (Young *et al*., 2003).

After extensive literature review, it was found that despite of its role as food and medicine; there is lack of study on seed propagation techniques of for *R. semialata* Murray. Therefore an experiment was carried out with the objective to investigate the possibility of propagation of *R. semialata* Murray by seeds as they are easily and abundantly available by observing the germination of seeds in field condition.

2. MATERIALS AND METHODS

The present study for propagation of *Rhus semialata* Murray was conducted in the nursery of the NWFPs division, Forest Research Institute, Dehradun, Uttarakhand, India, which is situated at 30˚ 20’ 40’’ latitude and 77˚ 52’12’’ longitudes at an

altitude of 640.8 m above the mean sea level. The climate is sub-tropical with an average mean annual precipitation of 2000mm. The average maximum temperature was 26.63°C, whereas average minimum temperature was 21.95°C for the period when the experiment was being carried out.

Seeds of *R. semialata* Murray were collected from Mao (Manipur, India) located at an elevation of about 6000ft above msl, where they grow naturally and produce good fruits. Two types of seeds viz. freshly collected seeds and seeds, which were stored for 1 year, were used for the experiment.

An area of 1.5m x1m was selected for the nursery bed in the experimental site. The soil was dug and was kept within the nursery bed area. Lumps of soil, which were dug out were broken down to get even texture of soil by crushing and grinding them between palms of hand or by using hoe. Weeds, pebbles, stones and other unwanted materials were removed from soil by hand picking as well as by sieving. Sand was mixed with the soil to facilitate drainage and improvement of root penetration and soil aeration. Farmyard Manure was also added to the soil. The ratio of soil, sand and farmyard manure was 2:1:1. They were mixed uniformly and were evenly spread within the nursery bed area. Bricks were placed along the borders of nursery bed at three sides to provide structural and strength to the beds. One side was kept without brick wall to facilitate drainage.

Also 100 fresh seeds were treated with 0.5% Sulphuric acid for 5 minutes. Then they were properly rinsed with running water to remove acid.

At first seeds of 1 year old fruits were sown in 15 rows which were followed by sowing of 200 seeds of fresh fruits in another 15 rows. Then acid treated fruits were sown in 8 rows. Watering and weeding were carried out as per the requirement. Daily visit was made to observe the germination of seeds and to record the observations. The data recorded were subjected to statistical analysis by using $\chi 2$-test test of independence with IBM SPSS-16.

3. RESULTS

The seeds started germinating (Figure 1) after 35 days from the day of sowing, which continued for another 23 days, after which no new seeds germinated even after a month. Out of 200 fresh seeds, only 4 seeds germinated and out of 200 one year old seeds, only 28 seeds germinated (Table 1). In case of seeds which were treated with 0.5% dil. sulphuric acid, 28 seeds out of 100 sown seeds germinated.

Figure 2: Different Stages of the Germination of Seeds.

Only 2% of fresh seeds germinated. The percentage of one year old seeds that germinated was 14% and the percentage of acid treated seeds that germinated was 28%. The count of germinated fresh seeds was 2, which was less than the expected count of 24. But, in case of one year old seeds and acid treated seeds, the counts of seeds germinated in both were 28, which were more than the expected counts of 24 and 12, respectively (Table 1).

Table 1: No. of Seeds Sown and No. of Seeds Germinated

			Germination		Total
			Germinated	Not Germinated	
Treatment	Fresh seeds	Count	4	196	200
		Expected Count	24.0	176.0	200.0
		% within treatment	2.0%	98.0%	100.0%
	1 year old seeds	Count	28	172	200
		Expected Count	24.0	176.0	200.0
		% within treatment	14.0%	86.0%	100.0%
	Dil. Sulphuric acid treated fresh seeds	Count	28	72	100
		Expected Count	12.0	88.0	100.0
		% within treatment	28.0%	72.0%	100.0%
Total		Count	60	440	500
		Expected Count	60.0	500.0	500.0
		% within treatment	12.0%	88.0%	100.0%

After running through $\chi 2$-test, it was observed that there was significant relationship between seed germination, time of the seed collection and pre-treatment with the dil. Sulphuric acid as the value of $p < 0.001$ for 2 degree of freedom (Table 2).

Table 2: Chi-Square Test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.939[a]	2	.000
No. of Valid Cases (N)	500		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.00.			

4. DISCUSSIONS

The fresh seeds gave very little germination of 2%, whereas one year old seeds gave 14% germination. The seeds, which were subjected to pre- treatment with 0.5% dilute sulphuric acid, gave much better germination of 28% as compared to one year old seeds. Thus, the performance of seed germination was very poor in fresh seeds, better in one year old seeds and best in seeds which were treated with 0.5% dilute Sulphuric acid before sowing. The χ2-test also confirmed this observation by indicating the significant relationship between seed germination and the treatments that were given to the seeds.

The poor germination of the fresh seeds could be due to the presence of dormancy. The presence of physical and physiological dormancy in other species of Rhus such as *R. aromatica* Linn and *R. trilobata* clade was reported by Li et al. (1999). So, there is a possibility that the similar type of dormancy is also present in *R. semialata* Murray. Since the seed germination count significantly improved after seeds were left for one year or treated with 0.5% dilute Sulphuric acid, indicating the presence of dormancy either due to hard seed coat or due to the presence of germination inhibitors. Huxley, A. (1992) suggested pre-soaking of the seed for 24 hours in hot water (starting at a temperature of 80 - 90c and allowing it to cool) prior to sowing, in order to leach out any germination inhibitors.

5. CONCLUSIONS

Rhus semialata can be propagated by seeds, as it is much simpler and easier method than the propagation by cuttings, and seeds are easily and abundantly available. The direct sowing of freshly collected seeds is not advisable. They can be pre- soaked in hot water (Huxley, A., 1992) or pre-treated with acid to get best germination. Also, seeds can be collected and stored for one year (or more) before sowing to ensure better germination than the fresh fruits.

ACKNOWLEDGEMENT

Author would like to thank Dr. Lokho Puni, Addl. PCCF, Manipur, India and Dr. Pradeep Sharma, Scientist –B, Chemistry Division, FRI, Dehradun, India for their guidance as well as for assistance in obtaining materials required for this research.

REFERENCES

1. *Anonymous, (2003), The Wealth of India (9), National Institute of Science Communication, CSIR, New Delhi, India, p. 19.*
2. *Bhattacharjee SK., (1998), Handbook of Medicinal Plants, Pointer Publishers, Jaipur, India, pp. 299.*
3. *Bidyalakshmi, L., Rajendran, A., Salavath, J. (2019), Nutrient and phytonutrient composition of Rhus semialata, an underutilised fruit of north east India, Volume 8, Issue 3, , www.ijfans.com e-ISSN: 2320–7876, International Journal Of Food And Nutritional Sciences*
4. *Bose, S. K., Maity, S., Dewanjee, S., Mandal, S. C., Sen. Gupta, A., (2010), Antimicrobial potential of Rhus semialata murr. against bacterial diarrhoea, Journal of Pure and Applied Microbiology, Vol.4 (2) , pp. 879–882*
5. *Bose, S. K., Dewanjee, S., Gupta, A. S., Samanta, K. C., Mintu Kundu, Mandal, S. C., (2008), In Vivo Evaluation of Antidiarrhoeal Activity of Rhus semialata Fruit Extract in Rats, African Journal of Traditional, Complementary and Alternative Medicines 5(1), pp. 97–102.*
6. *Costadinnova, L., Kolusheva, T,, Ivanova, D., Partov, A., (2007), Analysis of gallotannin in sumac part I: Titrimetric method for the determination of gallotanin in sumac extract Journal of the Society of Leather Technologies and Chemists 91 (6) , pp. 243–245.*

7. *Djakpo, O. and Yao, W., (2010), Rhus chinensis and Galla Chinensis-folklore to modern evidence: review, Phytotherapy Research (12), pp.1739–47.*
8. *Gurung G, (2002), Rhus semialata Murr, The Medicinal Plants of Sikkim Himalaya, West Sikkim, p. 339.*
9. *Huxley, A.(1992), The New RHS Dictionary of Gardening. MacMillan Press*
10. *Ippen, H., (1983), Kontaktallergie gegen anacardiaceen. Ubersicht und kasuistik zur 'poison ivrey' allergie in miteleuropa, Contact allergy to Anacardiaceae: A review and case studies of poison ivy allergy in Central Europe, Dermatosen in Beruf und Umwelt 31 (5) , pp. 140–148.*
11. *Kim, N. S., Jeong, S. I., Hwang, B. S., Lee, Y. E., Kang, S. H., Lee, H. C., Oh, C. H., (2011), Gallic acid inhibits cell viability and induces apoptosis in human monocytic cell line U937, Journal of Medicinal Food. 14(3), pp. 240–246.*
12. *Kiritikar, K. R, Basu, B. D, (1887), Rhus semialata Murr., Indian Medicinal Plants,: International Book Distributors, Dehradun, pp. 646–647.*
13. *Kolusheva, T., Costadinnova, L., Ivanova, D., (2008), Analysis of gallotannin in the tanning substances of sumac part 2: Titrimetric method for the determination of gallotannin in residual solutions from sumac extract tanning Journal of the Society of Leather Technologies and Chemists 92 (1) , pp. 19–22.*
14. *Kuo, S. C., Teng, C. M., Lee, L.-G., Chiu, T. H., Wu, T. S., Huang, S. C., Wu, J. B., Chou, T. C., (1991), 6-Pentadecylsalicylic acid; An antithrombin component isolated from the stem of Rhus semialata var. roxburghii, Planta Medica 57 (3) , pp. 247–249.*
15. *Kuo, Y. C., Sun, C. M., Tsai, W. J., Ou, J. C., Chen, W. P., Lin, C. Y., (1999), Blocking of cell proliferation, cytokines production and genes expression following administration of chinese herbs in the human mesangial cells, Life Sciences 64 (23) , pp. 2089–2099.*
16. *Li X., Baskin, J. M. & Baskin, C. C. (1999). Anatomy of two mechanisms of breaking physical dormancy by experimental treatments in seeds of two North American Rhus species (Anacardiaceae). American Journal of Botany 86: 1505–1511.*
17. *Ouyang, M. A., Chang, C. I., Wein, Y. S., Kuo, Y. H., (2008), New phenol glycosides from the roots of Rhus javanica var. roxburghiana, Journal of the Chinese Chemical Society 55 (1) , pp. 223–227.*
18. *Ouyang, M. A., Wein, Y. S., Su, R. K., Kuo, Y. H., (2007), Rhusemialins A - C, new cyclolignan esters from the roots of Rhus javanica var. roxburghiana, Chemical and Pharmaceutical Bulletin 55 (5) , pp. 804–807.*
19. *Parveen, N., Singh, M. P., Khan, N. U., Achari, B., Logani, M. K., (1991), Semialatic acid, a Triterpene from Rhus semialata, Phytochemistry, 30 (7) , pp. 2415–2416.*
20. *Rai L, Sharma E., (1994), Rhus semialata Murr, Medical plants of the Sikkim Himalayan., Bishen Singh Mahendra publication,. pp. 68.*
21. *Ramakrishna, N. V. S., Jain, A. K., Kota, S., Vijaya Kumar, E. K. S., Kalakoti, S., Gupte, R. D., Panicker, R. B., Vadlamudi, R. V. S. V., (2001), Screening of natural products for new leads as inhibitors of IκBα kinase: 2-Hydroxy-6-substituted benzoic acids from plant extracts, Section B Organic and Medicinal Chemistry , Indian Journal of Chemistry 40 (4) , pp. 345–347.*
22. *Tian, F., Lia, Ji, B., Zhang, G. and Luo, Y. (2009), Identification and structure–activity relationship of gallotannins separated from Galla chinensis, LWT, Food Science and Technology, 42(7), pp- 1289–1295.*
23. *Durairaj, P., & Kamaraj, M. (2013). Assessment and Conservation Strategies for Santalum album in Manmalai RF of Thuraiyur Range At Tiruchirappalli District. Intl J Human Arts Med Sci, 1(1), 1–12.*

24. *Tian, F., Lia, Ji, B., Yang, J., Zhang, G., Chen, Y. and Luo, Y., (2009), Antioxidant and antimicrobial activities of consecutive extracts from Galla chinensis:The polarity affects the bioactivities, Food Chemistry, 113(1), pp 173–179.*
25. *Stroyan, H. G., (1997), Aphid, Encyclopedia of Science and Technology, McGraw-Hill, 8th Edition.*
26. *Hung, D. Q., Hui, z. W., Gaudel, G., & Hoa, H. N. V. Propagation of lacquer tree (toxicodendron succedaneum) by grafting method.*
27. *Wang, Y., Xu, Z., Bach, S. J., McAllister, T. A., (2009), Sensitivity of Escherichia coli to seaweed (Ascophyllum nodosum) phlorotannins and terrestrial tannins, Asian-Australasian Journal of Animal Sciences 22 (2) , pp. 238–245.*
28. *Wu, Y. B., Kuo, Y. H., Ouyang, M. A., (2010), Novel 4-(2-methylphenyl)-flavan, Rhusjavanins A and B, from the roots of Rhus semialata,. Natural Product Research, 24 (17), pp. 1643–1647.*
29. *Otusanya, O. O., Ogunwole, A. A., & Tijani, M. O. (2015). Allelopathic effect of Tithonia diversifolia and Chromolaena odorata on the germination, growth and chlorophyll accumulation of Hibiscus sabdariffa (L.). International Journal of Botany and Research, 5(3), 1–14.*
30. *Young, J. S., Ho, K. D., Se, Y. A., Yong, S. K., Je, K. S., In, S. P., Bon, H. M., (2003), Inhibitory effect of aqueous extract from the gall of Rhus chinensis on alpha-glucosidase activity and postprandial blood glucose, Journal of Ethnopharmacology, 85(2-3), pp. 283–287.*
31. *Zhang J., Li L., Kim, S. H., Hagerman, A. E., Lü, J. (2009), Anti-cancer, anti-diabetic and other pharmacologic and biological activities of penta-galloyl-glucose, Pharmaceutical Research (26), pp. 2066–2080Anonymous.(2003). The Wealth of India (9), National Institute of Science Communication, CSIR, New Delhi, India, pp. 19.*
32. *Zhasa N. N., Hazarika, P., Tripathi Y. C.(2015), Indigenous Knowledge on Utilization of plant Biodiversity for Treatment andCure of diseases of Human beings in Nagaland, India: A case study, International Research Journal of Biological Sciences, Vol. 4(4), pp.89–106*
33. *Surendhiran, M., Raja, K., Jerlin, R., Marimuthu, S., & Srivignesh, S. Nano Emulsion Seed Invigouration for Improved Germination and Seedling Vigour in Maize*

AUTHOR PROFILE

Nada Tadi, Student, Author has done Bachelor in Forestry from the College of Horticulture and Forestry, Pasighat under Central Agricultural University, Imphal (Manipur), India and completed his Master in Forestry from Forest Research Institute, Dehradun (Uttarakhand), India. He is a holder of UGC NET and JRF in Environmental Sciences and ICAR NET in Agroforestry. He has worked as a Junior Technical Assistant (JTA) in Forest survey of India, Central zone, Nagpur. At present he is pursuing Bachelor of Arts (Honours) in Japanese language from Jawaharlal Nehru University, New Delhi, India.